Artículo nº 98 ISSN 1989-7170

BV news

Publicaciones Científicas

The genus *Leucozona* Schiner, 1860 on the Iberian Peninsula, including the first records of *Leucozona laternaria* (Müller, 1776) (Diptera: Syrphidae)

El género *Leucozona* Schiner, 1860, en la Península Ibérica, incluidas las primeras citas de *Leucozona laternaria* (Müller, 1776) (Diptera: Syrphidae)

Marián Álvarez Fidalgo [1], **Piluca Álvarez Fidalgo** [2], **Antonio Ricarte Sabater** [3], **María Ángeles Marcos García** [4]

1. Expert of the Odonata group and collaborator of the Diptera group of Biodiversidad Virtual – Oviedo, Asturias (Spain) – madamcoolpix@gmail.com
2. Co-coordinator of the Diptera group of Biodiversidad Virtual – Madrid (Spain) – pilucaaf@gmail.com
3. Researcher at the University of Alicante and expert in Syrphidae of the Diptera group of Biodiversidad Virtual – Alicante (Spain) – ricarte24@gmail.com
4. Professor of Zoology at the University of Alicante and expert in Syrphidae of the Diptera group of Biodiversidad Virtual – Alicante (Spain) – marcos@ua.es

ABSTRACT: The occurrence of *Leucozona laternaria* (Müller, 1776) is reported on the Iberian Peninsula for the first time. New records of the other species of *Leucozona* Schiner, 1860 present in the area under study are also reported. A key to the three Iberian species of this genus follows.
KEY WORDS: *Leucozona* Schiner, 1860, key to species, Iberian distribution, Spain.

RESUMEN: Se registra, por primera vez en la Península Ibérica, la presencia de *Leucozona laternaria* (Müller, 1776). Además, se presentan nuevas citas para la Península Ibérica de las otras especies del género *Leucozona* Schiner, 1860, registradas en el área de estudio. A continuación, se presenta una clave para la identificación de las tres especies ibéricas de este género.
PALABRAS CLAVE: *Leucozona* Schiner, 1860, clave de especies, distribución ibérica, España.

Introduction

The Syrphidae, commonly known as hoverflies, flower flies or syrphid flies, is a morphologically very diverse family of flies that includes species ranging from the large, bulky, and hairy to the small, slender, and shiny. Common features of the family are large eyes (often wider than the front of the thorax) and distinctive wing venation in which veins run parallel to the hind edge of the wing giving the appearance of a false margin (VAN VEEN, 2004). Another important feature is the presence in most species of a spurious vein (also called false vein or *vena spuria*), which is a chitinized fold in the wing running along the central

axis through vein r-m, and not connected to either end (STUBBS & FALK, 2002; VAN VEEN, 2004). As their common names suggest, hoverflies are often seen hovering or feeding on nectar at flowers. In fact, some adult hoverflies are important pollinators (AGUADO MARTÍN *et al.*, 2015). In some species, the larvae are saprophagous (eating decaying organic matter), phytophagous (eating vegetal tissues in geophytes) or microphagous (aquatic species living in ponds and streams, that consume detritus and bacteria). In other species, the larvae are insectivores, preying on aphids, and other plant-sucking insects (VAN VEEN, 2004), which make them efficient biological control agents (GROSSKOPF, 2005).

The genus *Leucozona* Schiner, 1860 gathers large hoverflies within the subfamily Syrphinae, which present sexual dimorphism and a contrasting black and pale abdominal pattern, basically with extensive pale spots on tergite 2 and smaller to absent spots in tergites 3 and 4 (VAN VEEN, 2004), providing a unique pattern among hoverflies (Fig. 1). *Leucozona* are damp forest species, which occur in the forest shade as well as on flowers along the forest edge. Their larvae prey on aphids (VAN VEEN, 2004).

Fig. 1: Female of *Leucozona glaucia* (Linnaeus, 1758) showing its abdominal colour pattern. Note the extensive pale spots on tergite 2 and smaller transversal markings in tergites 3 and 4. Riofabar (Piloña, Asturias, Spain), 16-IX-2012, (ÁLVAREZ, 2012).
http://www.biodiversidadvirtual.org/insectarium/Leucozona-glaucia-(Linnaeus-1758)-img402773.html

A total of 16 species of *Leucozona* are regarded as valid worldwide in Systema Dipterorum (PAPE & THOMPSON, 2013). Eight of them are present in the Palearctic. SPEIGHT (2016) accepts five species found in Europe: *Leucozona glaucia* (Linnaeus, 1758), *Leucozona inopinata* Doczkal, 2000, *Leucozona laternaria* (Müller, 1776), *Leucozona lucorum* (Linnaeus, 1758) and *Leucozona nigripila* Mik, 1888, which is considered a European species, as it occurs at the very edge of the continent, in the Caucasus Mountains (SPEIGHT, 2016). *Leucozona strandi* (Duda, 1940), a taxon from the Czech Republic and Slovakia, catalogued in Systema Dipterorum, is not accepted by SPEIGHT (2016).

DUŠEK & LÁSKA (1967) included *L. glaucia* and *L. laternaria* under a different genus, *Ischyrosyrphus* Bigot 1882. HIPPA (1968) placed *Ischyrosyrphus* under *Leucozona* as a subgenus, and MENGUAL *et al.* (2008) confirmed their close phylogenetic relationship. Species of the subgenus *Ischyrosyrphus* are morphologically similar to those of the subgenus *Leucozona*, but lack the distinct black markings on the wings (MIRANDA *et al.*, 2013) and have the abdomen parallel-sided and mostly

unmarginated (sometimes with very weak margin on tergites 4 and 5), while species of the subgenus *Leucozona* have oval-shaped abdomens that are marginated.

For the present study, and for geographic convenience, we consider all of the Iberian Peninsula and the valleys facing north situated in the Pyrenees within Spanish territory. From now on, we will still refer to the territory under study as the Iberian Peninsula, for clarity.

Among all European species of *Leucozona*, only *L. glaucia* and *L. lucorum* are included in the checklist of Spanish hoverflies (RICARTE & MARCOS GARCÍA, 2017). The genus has not been reported in Portugal so far (VAN ECK, 2016). As for *L. laternaria*, in this paper we present the first records from the Iberian Peninsula (Spain). MARCOS-GARCÍA (1988, 1990) reported the first *Leucozona* hoverfly from the region, *L. lucorum*, found in Tielve, Asturias, Spain. This species was not observed again on the Iberian Peninsula (MARCOS-GARCÍA *et al*., 2002) until CLAVELL (2009) photographed a female in Eyne (Eastern Pyrenees, France). MENGUAL *et al.* (2008) provided data on one specimen of *L. glaucia* from Aran Valley (Pyrenees, Spain) in a table of material used in molecular analysis. Although this was the first documented record of *L. glaucia* from Spain, MENGUAL *et al.* (2008) did not mention this fact. This might be the reason why *L. glaucia* is not included in major data bases such as Fauna Europaea (SPEIGHT, 2018) and Systema Dipterorum (PAPE & THOMPSON, 2013) as present in Spain. In spite of the late and obscure first record of *L. glaucia* from Spain, this species appears in several photos taken in the region under study and published in the online database BiodiversidadVirtual.org (BIODIVERSIDAD VIRTUAL, 2018) from 2008 to 2015.

As several photographic records of the species of this genus seem to have passed unnoticed by the scientific community, we put them together in this work and present an identification key to distinguish the Iberian species.

Fig. 2: Female *Leucozona laternaria* (Müller, 1776), first record of the species for Spain. Pola de Laviana (Asturias, Spain), 24-VIII-2005, (CANDELA, 2013b).
http://www.biodiversidadvirtual.org/insectarium/Leucozona-laternaria-(Muller-1776)-img441086.html

Material and methods

The first news about the presence of *L. laternaria* on the Iberian Peninsula dates from a series of photographs uploaded to the online database BiodiversidadVirtual.org (Fig. 2) (CANDELA, 2013b). The pictures were taken in Pola de Laviana (Asturias), on 24-VIII-2005, using a Fujifilm FinePix S7000 camera. The specimen was a female, found feeding on Umbelliferae flowers in a meadow next to a path crossing a woodland area where chestnut (*Castanea sativa* Mill.) was the predominant tree. The second author of the present paper saw the images and recognized the photographed specimen as *L. laternaria*, since it is quite a distinctive species (see Results and Discussion) and can be identified unequivocally from a photo.

Fig. 3: Female *Leucozona laternaria* (Müller, 1776), second record of the species for Spain. Soto de Rey (Ribera de Arriba, Asturias, Spain), 26-VIII-2015. (Photo: Luis Óscar Aguado Martín)

Fig. 4: Views of some habitats where *Leucozona laternaria* (Müller, 1776) was found in Asturias: a) Soto de Rey, Ribera de Arriba. (Photo: Marián Álvarez Fidalgo); b) Luces, Colunga. (Photo: Nacho Noval Fonseca)

Fig. 5: *Leucozona laternaria* (Müller, 1776), third record of the species for Spain. Specimen collected in Luces (Colunga, Asturias, Spain), 6-IX-2015; a) dorsal view; b) lateral view. (Photos: André van Eck)

Two years later, a new record of *L. laternaria* appeared in BiodiversidadVirtual.org. In this case, on 26-VIII-2015, the species was reported by a group of naturalists (including the first two authors of the present paper) near the bank of the Nalón River, as it passes through Soto de Rey (Ribera de Arriba, Asturias, at about 233 masl). A female of *L. laternaria* was found on an inflorescence of wild angelica (*Angelica sylvestris* L.) and photographed with a Nikon D800 camera and Micro Nikkor 105 mm 1:2:8 G ED lens, using external flash (Fig. 3). The plant grew in the margin of a road crossing a riverside forest consisting mainly of alders (*Alnus glutinosa* (L.) Gaertn.), and to a lesser extent, willows (*Salix* sp.). The area where the hoverfly was found is 400 m from the river, and in this part of the forest other trees occur,

including maples (*Acer pseudoplatanus* L.), chestnuts, hazels (*Corylus avellana* L.), and shrubs such as elder (*Sambucus nigra* L.) and common dogwood (*Cornus sanguinea* L.), with understory vegetation consisting mainly of ferns (*Polystichum setiferum* (Forssk.) Woyn.), nettles (*Urtica dioica* L.) and brambles (*Rubus* sp.) (Fig. 4a). The finding took place at around 4:20 p.m., on a cloudy summer day but warm and humid, with hardly any wind. The area was shaded by the riparian trees.

Finally, the second author of the present paper observed and collected a female specimen of *L. laternaria* on 6-IX-2015 in Luces, Colunga, Asturias (about 130 masl), in the vicinity of a brook called Arroyo del Cueto. The hoverfly was feeding on wild angelica along with other species of flies of the genus *Cheilosia* Meigen, 1822 (Syrphidae), *Clytiomyia continua* (Panzer, 1798), and *Solieria vacua* (Rondani, 1861) (Tachinidae). The angelica plant grew in a meadow surrounded by the mentioned brook and alongside a forest of alders and willows, and non-native eucalyptus (*Eucalyptus* sp.) (Fig. 4b). Other flowering plants attracting insects in the meadow included wild carrot (*Daucus carota* L.), common fleabane (*Pulicaria dysenterica* (L.) Bernh.), and common yarrow (*Achillea millefolium* L.). The observation and collection took place in the early part of a typical late-summer afternoon in Asturias. It was humid and warm, with noticeable activity of Diptera and Hymenoptera on the flowering plants. The specimen was deposited in the private collection of André van Eck (Tilburg, The Netherlands) and photographed for this paper with a Panasonic DMC-FZ28 camera (Fig. 5).

Different public databases were checked (GBIF, 2018; OBSERVATION.ORG, 2018), as well as several Spanish institutional collections, in order to find additional records of this taxon. ANADÓN (1984) provided a checklist of the hoverfly species found in the Colección de Artrópodos del Departamento de Biología de Organismos y Sistemas de la Universidad de Oviedo (BOS). Since most photographic records of *L. laternaria* from the Iberian Peninsula originate in Asturias, we visited this collection and studied all the material collected after 1984, but no records of any *Leucozona* species were found. The collections in the following institutions were also consulted to ensure there was no evidence of *Leucozona* hoverflies from the territory under study: Museo Nacional de Ciencias Naturales, Madrid (MNCN); Universidad Complutense de Madrid (UCME); and Colección Entomológica de la Universidad de Alicante (CEUA), located at the CIBIO Research Institute.

Results and Discussion

The only evidence of *L. laternaria* on the Iberian Peninsula appears to be restricted to the records provided in this paper, as no records have been found in the literature, nor any specimens located in the checked collections. Table 1 summarizes the information related to all records available and verified on the three *Leucozona* species detected on the Iberian Peninsula, both from pinned specimens and material identified from photographs taken in the wild and uploaded to the online database BiodiversidadVirtual.org.

***Leucozona glaucia* (Linnaeus, 1758)**					
Reference	**Record date**	**Locality**	**Province**	**UTM**	**Altitude**
RAMOS (2016)	20-VIII-2014	Barbeitos (Fonsagrada)	Lugo	29TPH68	905
BERTOLACCINI *et al.* (2012) (*)	9-II-1998	Brañuelas (Villagatón)	León	29TQH22	1100
HARRIES (2014)	10-VIII-2014	Salas	Asturias	29TQJ20	252
CANDELA (2013a)	23-VIII-2004	Sobrescobio	Asturias	30TTN98	842
ÁLVAREZ (2012)	16-IX-2012	Riofabar (Piloña)	Asturias	30TUN09	323
ALOMAR (2009a)	12-VIII-2009	Tarna (Caso)	Asturias	30TUN17	1020
ALOMAR (2009b)	12-VIII-2009	Caleao (Caso)	Asturias	30TUN08	708
DO REGO & JUÁREZ (2009)	10-VIII-2009	Saja (Los Tojos)	Cantabria	30TUN97	618
CLAVELL (2011)	7-VII-2011	Alós d'Isil (Alt Àneu)	Lleida	31TCH43	1479
CLAVELL (2015)	5-VIII-2014	Son (Alt Àneu)	Lleida	31TCH41	1537
MENGUAL *et al.* (2008) (*)	I-VIII-2003	Arties (Naut Aran)	Lleida	31TCH22	1500

FORNOS (2016)	3-VII-2016	Pardines	Girona	31TDG38	1241
***Leucozona laternaria* (Müller, 1776)**					
Reference	**Record date**	**Locality**	**Province**	**UTM**	**Altitude**
CANDELA (2013b)	24-VIII-2005	Pola de Laviana	Asturias	30TTN99	296
ÁLVAREZ (2015a)	26-VIII-2015	Soto de Rey (Ribera de Arriba)	Asturias	30TTN69	233
Present paper (*)	6-IX-2015	Luces (Colunga)	Asturias	30TUP11	134
***Leucozona lucorum* (Linnaeus, 1758)**					
Reference	**Record date**	**Locality**	**Province/ district**	**UTM**	**Altitude**
MARCOS-GARCÍA (1988) (*)	21-VI-1987	Tielve (Cabrales)	Asturias	30TUN59	600
CLAVELL (2009)	16-VII-2009	Eyne	Eastern Pyrenees (France)	31TDH20	1944

Table 1: Known data on the three species of *Leucozona* Schiner, 1860 found so far in the territory under study (Iberian Peninsula and Aran Valley). The date of the observation, place of the observation and its province, UTM and altitude (in masl) are indicated. The symbol (*) refers to records from pinned specimens.

All records known from Spain are shown in figure 6. A 10 km × 10 km grid map of Spain (MINISTERIO DE AGRICULTURA Y PESCA, ALIMENTACIÓN Y MEDIO AMBIENTE, 2018) has been used to plot specific locations in the provinces of Lugo, León, Asturias, Cantabria, Huesca, Lleida, and Girona. Below it, a general map of the Spanish provinces (D-MAPS.COM, 2018) shows the placement of these northern provinces on the Iberian Peninsula and within Spain.

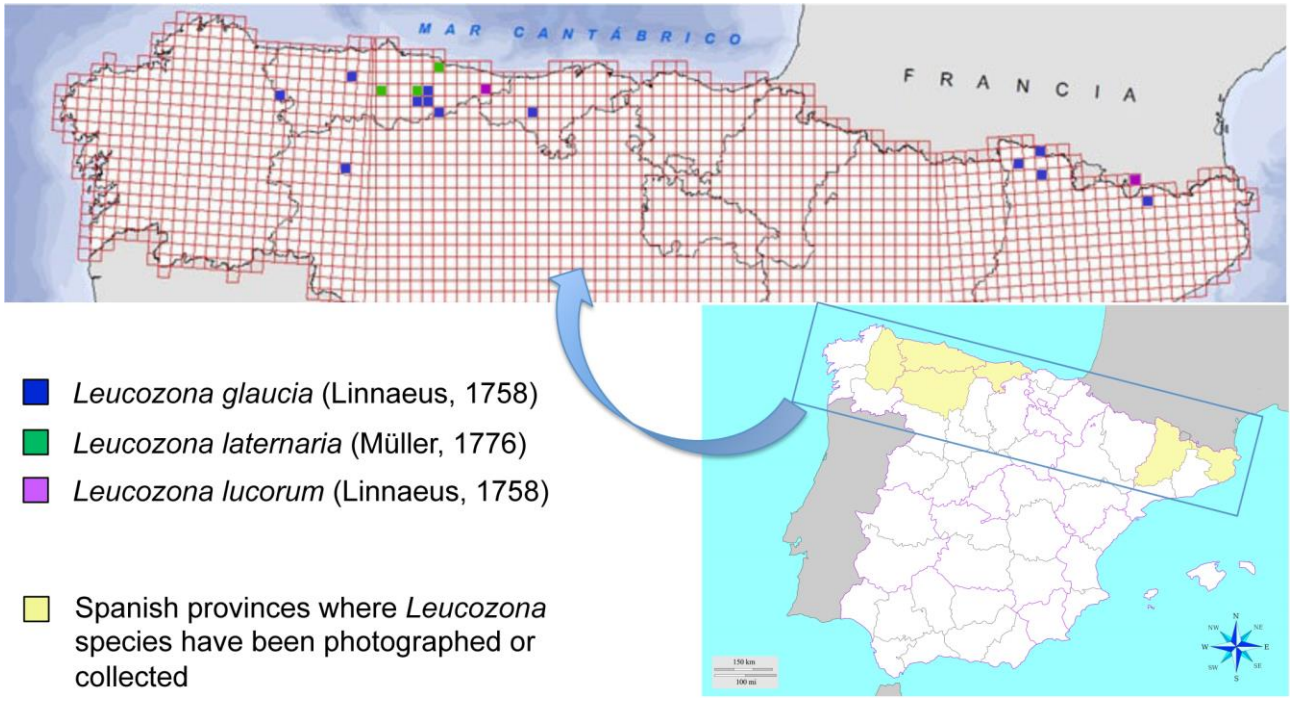

Fig. 6: Distribution map of the three *Leucozona* species found on the Iberian Peninsula, created from literature references, collected specimens, and records by nature photographers. Provinces in Spain where *Leucozona* species have been registered, and the 10 km × 10 km grid map of northern Spain where each species has been recorded are featured.

Identification of the *Leucozona* species from the Iberian Peninsula

In order to facilitate their identification, we provide information to separate the Iberian species of *Leucozona* from similar species of other genera, as well as a key to *Leucozona* species.

All Iberian *Leucozona* species should be readily identified by the pattern and coloration of their abdomens, with large creamy white or bluish rectangular markings on tergite 2, much larger than any markings on the rest of the abdomen (BALL & MORRIS, 2015). However, *Epistrophe leiophthalma* (Schiner & Egger, 1853) (Fig. 7a), a species from mountains of central Europe (not registered on the Iberian Peninsula but likely to be found in the Pyrenees), is remarkably similar to *L. glaucia* in general appearance, particularly in the field. In fact, it has traditionally been regarded as belonging to *Leucozona* (SPEIGHT, 2016), but VOCKEROTH (1969) transferred *E. leiophthalma* to *Epistrophe* Walker, 1852, on the basis of characters of the male terminalia. The most convenient distinguishing feature is that the eyes are bare in *E. leiophthalma*, whereas they are distinctly hairy in *L. glaucia* (SPEIGHT & SARTHOU, 2016).

Fig. 7: Some hoverfly taxa likely to be confused with *Leucozona* species. Species resembling *Leucozona laternaria* (Müller, 1776): a) *Epistrophe leiophthalma* (Schiner & Egger, 1853) (bare eyes indicated with an arrow). (Photo: Alan Outen). Bumblebee mimics present on the Iberian Peninsula or likely to be found, which resemble *Leucozona lucorum* (Linnaeus, 1758): b) *Cheilosia illustrata* (Harris, 1780) (arrows indicating the black scutellum and the white hairs of tergite 2). (Photo: Peter Andrews); c) *Eriozona syrphoides* (Fallén, 1817) (yellow face and yellow hairs along the hind margin of the abdomen are indicated). (Photo: Peter Andrews); d) *Volucella pellucens* (Linnaeus, 1758) (the plumose arista and the diagnostic re-entrant outer cross-vein of *Volucella* are indicated), Visuña (Lugo, Spain), 6-VIII-2015, (ÁLVAREZ, 2015b).
http://www.biodiversidadvirtual.org/insectarium/Volucella-pellucens-(Linnaeus-1758)-img767454.html

On the other hand, *L. lucorum* is a Bumblebee mimic resembling vaguely *Cheilosia illustrata*

(Harris, 1780) (Fig. 7b), *Eriozona syrphoides* (Fallén, 1817) (Fig. 7c), and *Volucella pellucens* (Linnaeus, 1758) (Fig. 7d). *L. lucorum* is most likely to be confused with *C. illustrata* (Fig. 7b), but in that species the scutellum is black rather than yellow and the pale areas are due to white hairs, not markings (BALL & MORRIS, 2015). *E. syrphoides* (Fig. 7c) has not been recorded yet on the Iberian Peninsula (RICARTE & MARCOS GARCÍA, 2017), but it is present in the French Pyrenees (SPEIGHT, 2016). It should be easily recognized and separated from *L. lucorum* by the bright yellow face and the presence of yellow hairs on the front and hind margins of the abdomen (VAN VEEN, 2004; BALL & MORRIS, 2015). *V. pellucens* has a vaguely similar colour pattern to *L. lucorum* but the latter species lacks the plumose arista and distinctive wing venation of *Volucella* Geoffroy, 1762 (with the re-entrant outer cross-vein, Fig. 7d). Finally, *L. laternaria* can only be confused with *L. glaucia*, bearing in mind the resemblance of the latter with *E. leiophthalma*, as discussed above.

Fig. 8: Diagnostic features of the Iberian *Leucozona* species: a) *Leucozona laternaria* (Müller, 1776), Pola de Laviana (Asturias, Spain), 24-VIII-2005, (CANDELA, 2013b); b) *Leucozona lucorum* (Linnaeus, 1758), Eyne (Eastern Pyrenees, France), 16-VII-2009, (CLAVELL, 2009); c) and d) *Leucozona glaucia* (Linnaeus, 1758), female, Son (Alt Àneu, Lleida, Spain), 5-VIII-2014, (CLAVELL, 2015) and male, Salas (Asturias, Spain), 10-VIII-2014, (HARRIES, 2014), respectively. Red arrows indicate scutellum colour, blue arrows point to the presence or absence of darks spots behind the stigma, and orange arrows to the tibiae colour.
http://www.biodiversidadvirtual.org/insectarium/Leucozona-laternaria-(Muller-1776)-img441085.html
http://www.biodiversidadvirtual.org/insectarium/Leucozona-lucorum-(Linnaeus-1758)-img88171.html
http://www.biodiversidadvirtual.org/insectarium/Leucozona-glaucia-(Linnaeus-1758)-img729603.html
http://www.biodiversidadvirtual.org/insectarium/Leucozona-glaucia-(Linnaeus-1758)-img624715.html

The following key is based on STUBBS & FALK (2002), VAN VEEN (2004), and SPEIGHT & SARTHOU (2016). The most intuitive and easy-to-appreciate features have been used as primary characters. Due to variation in colour, size, and shape of the abdominal markings depending on sex and intraspecific variability, these characters have been relegated to the final position in the key.

(1a) Dorsal surface of scutellum black, at most with pale hind border. Wings without dark spots (black stigma excluded) (Fig. 8a) ……...……...…… ***Leucozona laternaria*** Müller
(1b) Dorsal surface of scutellum yellowish. Wings with or without dark spots. …… 2

(2a) Wing with a dark spot behind the stigma; all tibiae extensively black; tarsi of all legs black. Tergite 2 mainly white, grey, or pale yellow, with a black median line; tergite 3 black (often with front margin whitish); tergite 4 black (Fig. 8b) ……..…… ***Leucozona lucorum*** Linnaeus
(2b) Wings without dark spots except for the stigma; all legs extensively pale, mainly yellow. Tergite 2 with large white, grey, or pale yellow spots that are merged in males; tergites 3 and 4 with small whitish to grey spots (Figs. 8c, 8d) ……..……..... ***Leucozona glaucia*** Linnaeus

After the discovery of *L. laternaria* in Asturias, *L. inopinata* now is the only European *Leucozona* hoverfly not yet recorded on the Iberian Peninsula and likely to be found within the territory. Until recently, its distribution has been uncertain due to confusion with related species, but in recent years its presence has been confirmed in many countries from France to the Russian Far East (PROKHOROV & POPOV, 2016). This species seems to be quite widespread (but with a clustered distribution) through temperate parts of Europe in sandy environments (STUBBS & FALK, 2002). Areas with such habitats are well represented in Northern Spain and they should be carefully surveyed in order to detect *L. inopinata*. Separation of this species from *L. lucorum* is in fact fairly easy, as there are enough external characters to tell both species apart (DOCZKAL, 2000). The main characters mentioned in DOCZKAL (2000) to separate these two species are summarized in Table 2.

***Leucozona lucorum* (Linnaeus, 1758)**	***Leucozona inopinata* Doczkal, 2000**
Scutellum yellow with front edges dark	Scutellum wholly yellow
Tergite 4 covered predominantly with white hairs (black hairs may occur in the middle part)	Tergite 4 covered with black hairs
Eyes hairy	Eye hairs clearly shorter, inconspicuous
Postlateral corner of tergite 3 without pruinosity (males)	Postlateral corner of tergite 3 with pruinosity (males)
Lateral ridge of T4 with white or pale yellow hairs	Lateral ridge of T4 with black hairs only
Microtrichia covering less than 80% of bm cell	Microtrichia covering more than 80% of bm cell

Table 2: Main morphological differences between *Leucozona lucorum* (Linnaeus, 1758) and *Leucozona inopinata* Doczkal, 2000.

Based on the presented results, a further combined effort between photographers and entomologists would certainly improve the knowledge of the genus *Leucozona* on the Iberian Peninsula.

Conclusions

As a result of the present study, which is mainly based on photographic records, a total of three species of *Leucozona* are known to be found in Spain, with *L. laternaria* new to the Iberian Peninsula and *L. glaucia* new to the provinces of Asturias, Cantabria, Lugo and Girona. As this paper shows, nature photography has proven a useful tool, contributing to our formal knowledge of species distributions as well as providing information on the preferred habitats and other ecological information. In the case of this article, digital photography provided accurate distribution data on hoverfly species that can be identified by a photo, even representing first records for a broad area such as the Iberian Peninsula. New records of the

Leucozona species studied in this paper appear to confirm the northern distribution of this genus on the Iberian Peninsula.

Acknowledgements

We would like to thank very sincerely Howard Youth, who kindly corrected our non-native English. Very special thanks go to all the photographers who have uploaded their images of the target species of this paper to the website BiodiversidadVirtual.org: Esperança Alomar, Pedro Candela, Jordi Clavell, Pedro do Rego, Daniel Fornos, Carmen Juárez, Anabel & Geoff Harries, and Jorge Ángel Ramos. Our thanks are further extended to Luis Óscar Aguado Martín, Peter Andrews, Nacho Noval Fonseca, Alan Outen, and André van Eck, for kindly allowing us to use their images. We also thank Mercedes París (MNCN), Eduardo Ruiz (UCME), and Araceli Anadón Álvarez (BOS) for allowing us to study the material in the collections of their respective institutions. Antonio Ricarte's position at the University of Alicante is funded by the Vicerrectorado de Investigación y Transferencia de Conocimiento.

References

AGUADO MARTÍN, L. O., FERERES CASTIEL, A. & VIÑUELA SANDOVAL, E. (2015). *Guía de campo de los polinizadores de España*. Madrid. Mundi-Prensa. 369 pp.

ALOMAR, E. (2009a). *Leucozona glaucia* (Linnaeus, 1758). Photograph to be found on BiodiversidadVirtual.org [Online database]. Available from: https://www.biodiversidadvirtual.org/insectarium/Leucozona-glaucia-(Linnaeus-1758)-img85365.html. [Accessed on 8-VI-2018].

ALOMAR, E. (2009b). *Leucozona glaucia* (Linnaeus, 1758). Photograph to be found on BiodiversidadVirtual.org [Online database]. Available from: https://www.biodiversidadvirtual.org/insectarium/Leucozona-glaucia-(Linnaeus-1758)-img97673.html. [Accessed on 8-VI-2018].

ÁLVAREZ, M. (2012). *Leucozona glaucia* (Linnaeus, 1758). Photograph to be found on BiodiversidadVirtual.org [Online database]. Available from: https://www.biodiversidadvirtual.org/insectarium/Leucozona-glaucia-(Linnaeus-1758)-img402773.html. [Accessed on 8-VI-2018].

ÁLVAREZ, M. (2015a). *Leucozona laternaria* (Müller, 1776). Photograph to be found on BiodiversidadVirtual.org [Online database]. Available from: https://www.biodiversidadvirtual.org/insectarium/Leucozona-laternaria-(Muller-1776)-img735948.html. [Accessed on 8-VI-2018].

ÁLVAREZ, M. (2015b). *Volucella pellucens* (Linnaeus, 1758). Photograph to be found on BiodiversidadVirtual.org [Online database]. Available from: https://www.biodiversidadvirtual.org/insectarium/Volucella-pellucens-(Linnaeus-1758)-img767454.html. [Accessed on 8-VI-2018].

ANADÓN, A. (1984). La colección de sírfidos del Departamento de Zoología de la Universidad de Oviedo (Diptera: Syrphidae). *Boletín de Ciencias de la Naturaleza I.D.E.A.*, **33**: 121-138.

BALL, S. & MORRIS, R. (2015). *Britain's Hoverflies. A field guide. Second Edition. Fully revised and updated.* Princeton. Woodstock. Princeton University Press. 313 pp.

BERTOLACCINI, I., NÚÑES-PÉREZ, E. & TIZADO, E. J. (2012). Diversidad y proporción sexual de Syrphidae en cultivos de leguminosas y plantas espontáneas, en León (España). *Revista de Ciências Agrárias*, **35** (1): 99-107.

BIODIVERSIDAD VIRTUAL (2018). Online database. Available from: https://www.biodiversidadvirtual.org. [Accessed on 8-VI-2018].

CANDELA, P. (2013a). *Leucozona glaucia* (Linnaeus, 1758). Photograph to be found on BiodiversidadVirtual.org [Online database]. Available from: http://www.biodiversidadvirtual.org/insectarium/Leucozona-glaucia-(Linnaeus-1758)-img441082.html. [Accessed on 8-VI-2018].

CANDELA, P. (2013b). *Leucozona laternaria* (Müller, 1776). Photographs to be found on BiodiversidadVirtual.org [Online database]. Available from: https://www.biodiversidadvirtual.org/insectarium/Leucozona-laternaria-(Muller-1776)-img441085.html, https://www.biodiversidadvirtual.org/insectarium/Leucozona-laternaria-(Muller-1776)-img441086.html. [Accessed on 8-VI-2018].

CLAVELL, J. (2009). *Leucozona lucorum* (Linnaeus, 1758). Photograph to be found on BiodiversidadVirtual.org [Online database]. Available from: https://www.biodiversidadvirtual.org/insectarium/Leucozona-lucorum-(Linnaeus-1758)-img88171.html. [Accessed on 8-VI-2018].

CLAVELL, J. (2011). *Leucozona glaucia* (Linnaeus, 1758). Photograph to be found on BiodiversidadVirtual.org [Online database]. Available from: https://www.biodiversidadvirtual.org/insectarium/Leucozona-glaucia-(Linnaeus-1758)-img257011.html. [Accessed on 8-VI-2018].

CLAVELL, J. (2015). *Leucozona glaucia* (Linnaeus, 1758). Photograph to be found on BiodiversidadVirtual.org [Online database]. Available from: https://www.biodiversidadvirtual.org/insectarium/Leucozona-glaucia-(Linnaeus-1758)-img729603.html. [Accessed on 8-VI-2018].

DMAPS.COM (2018). Free maps. España / Reino de España. Fronteras, provincias. Available from: http://www.d-maps.com/carte.php?num_car=5672&lang=es . [Accessed on 9-VI-2018].

DO REGO, P. & JUÁREZ, C. (2009). *Leucozona glaucia* (Linnaeus, 1758). Photograph to be found on BiodiversidadVirtual.org [Online database]. Available from: https://www.biodiversidadvirtual.org/insectarium/Leucozona-glaucia-(Linnaeus-1758)-img86085.html. [Accessed on 8-VI-2018].

DOCZKAL, D. (2000). Redescription of *Leucozona nigripila* Mik and description of *Leucozona inopinata* spec. nov. (Diptera, Syrphidae). *Volucella*, **5**: 115-127.

DUŠEK, J. & LÁSKA, P. (1967). Versuch zum Aufbau eines natürlichen Systems mitteleuropäischer Arten der Unterfamilie *Syrphinae (Diptera)*. *Acta scientiarum naturalium Academiae scientiarum bohemoslovacae – Brno*, **1** (nova series 9): 349-390.

FORNOS, D. (2016). *Leucozona glaucia* (Linnaeus, 1758). Photograph to be found on BiodiversidadVirtual.org [Online database]. Available from: https://www.biodiversidadvirtual.org/insectarium/Leucozona-glaucia-(Linnaeus-1758)-img817859.html. [Accessed on 8-VI-2018].

GBIF (2018). Global Biodiversity Information Facility. Available from: https://www.gbif.org. [Accessed on 9-VI-2018].

GROSSKOPF, G. (2005). Biology and life history of *Cheilosia urbana* (Meigen) and *Cheilosia psilophthalma* (Becker), two sympatric hoverflies approved for the biological control of hawkweeds (*Hieracium* spp.) in New Zealand. *Biological Control*, **35**: 142-154.

HARRIES, A. & G. (2014). *Leucozona glaucia* (Linnaeus, 1758). Photograph to be found on BiodiversidadVirtual.org [Online database]. Available from: https://www.biodiversidadvirtual.org/insectarium/Leucozona-glaucia-(Linnaeus-1758)-img624715.html. [Accessed on 8-VI-2018].

HIPPA, H. (1968). A generic revision of the genus *Syrphus* and allied genera (Diptera, Syrphidae) in the Palaearctic region, with descriptions of the male genitalia. *Acta Entomologica Fennica*, **25**: 1-94.

MARCOS-GARCÍA, M. A. (1988). Nuevos géneros para la entomofauna ibérica (Diptera, Syrphidae). *Fragmenta Entomologica*, **20** (2): 155-158.

MARCOS-GARCÍA, M. A. (1990). Catálogo preliminar de los Syrphidae (Diptera) de la Cordillera Cantábrica (España). *Eos*, **66** (2): 83-100.

MARCOS-GARCÍA, M. Á., ROJO, S. & PÉREZ-BAÑÓN, C. (2002). Syrphidae. In: CARLES-TOLRÁ HJORTH-ANDERSEN, M. (coord.): *Catálogo de los Diptera de España, Portugal y Andorra (Insecta). Monografias S.E.A. Vol. **8***. Zaragoza. Sociedad Entomológica Aragonesa. 323 pp.

MENGUAL, X., STÅHLS, G. & ROJO, S. (2008). First phylogeny of predatory flower flies (Diptera, Syrphidae, Syrphinae) using mitochondrial COI and nuclear 28S rRNA genes: conflict and congruence with the current tribal classification. *Cladistics*, **24**: 543-562.

MINISTERIO DE AGRICULTURA Y PESCA, ALIMENTACIÓN Y MEDIO AMBIENTE (2018). Spain 10 km × 10 km grid map. Available from: http://www.mapama.gob.es/es/biodiversidad/temas/inventarios-nacionales/inventario-especies-terrestres/inventario-nacional-de-biodiversidad/bdn-ieet-default.aspx. [Accessed on 9-VI-2018].

MIRANDA, G. F. G., YOUNG, A. D., LOCKE, M. M., MARSHALL, S. A., SKEVINGTON, J. H. & THOMPSON, F. C. (2013). Key to the Genera of Nearctic Syrphidae. *Canadian Journal of Arthropod Identification*, **23**: 1-351.

OBSERVATION.ORG (2018). Free accessed online database. Available from: https://observation.org. [Accessed on 8-VI-2018].

PAPE, T. & THOMPSON, F. C. (2013). Systema Dipterorum. The BioSystematic Database of World Diptera. Version 1.5. [Online database]. Available from: http://www.diptera.org. [Accessed on 9-VI-2018].

PROKHOROV, A. V. & POPOV, G. V. (2016). The first record of *Leucozona inopinata* (Diptera: Syrphidae) from European Russia. *Ukrainska Entomofaunistyka*, **7** (4): 43-44.

RAMOS, J. A. (2016). *Leucozona glaucia* (Linnaeus, 1758). Photograph to be found on BiodiversidadVirtual.org [Online database]. Available from: https://www.biodiversidadvirtual.org/insectarium/Leucozona-glaucia-(Linnaeus-1758)-img790277.html. [Accessed on 8-VI-2018].

RICARTE, A. & MARCOS-GARCÍA, M. Á. (2017). A checklist of the Syrphidae (Diptera) of Spain, Andorra and Gibraltar. *Zootaxa*, **4216** (5): 401-440.

SPEIGHT, M. C. D. (2016). Species accounts of European Syrphidae 2016. In: SPEIGHT, M. C. D., CASTELLA, E., SARTHOU, J.-P. & VANAPPELGHEM, C. (eds.): *Syrph the Net: the database of European Syrphidae (Diptera)*. Vol. **93**. Dublin. Syrph the Net publications. 288 pp.

SPEIGHT, M. C. D. (2018). Syrphidae. In: BEUK, P. & PAPE, T. (coords.): Fauna Europaea: Diptera, Brachycera. Fauna Europaea version 2017.06 [Online database]. Available from: http://fauna-eu.org. [Accessed on 9-VI-2018].

SPEIGHT, M. C. D. & SARTHOU, J.-P. (2016). StN keys for the identification of the European species of various genera of Syrphidae 2016/Clés StN pour la détermination des espèces Européennes de plusieurs genres des Syrphidae 2016. In: SPEIGHT, M. C. D., CASTELLA, E., SARTHOU, J.-P. & VANAPPELGHEM, C. (eds.): *Syrph the Net: the database of European Syrphidae (Diptera)*. Vol. **92**. Dublin. Syrph the Net publications. 137 pp.

STUBBS, A. E. & FALK, S. J. (2002). *British Hoverflies: an illustrated identification guide*. *Second edition*. Hurst. British Entomological and Natural History Society. 469 pp.

VAN ECK, A. (2016). Hoverflies (Diptera, Syrphidae) new to the fauna of mainland Portugal, with an updated hoverfly checklist. *Boletín de la Sociedad Entomológica Aragonesa (S.E.A.)*, **59**: 187-203.

VAN VEEN, M. P. (2004). *Hoverflies of Northwest Europe. Identification keys to the Syrphidae*. Utrecht. KNNV Publishing. 254 pp.

VOCKEROTH, J. R. (1969). A revision of the genera of the Syrphini (Diptera: Syrphidae). *Memoirs of the Entomological Society of Canada*, **101** (62): 1-176.

Fecha de recepción: 15 de junio de 2018
Fecha de aceptación: 5 de julio de 2018
Fecha de publicación: 30 de julio de 2018

Una vez impreso quedará depositado en la sede social de la Asociación Fotografía y Biodiversidad.

Volumen 7, páginas 128-141

Si desea enviar un artículo: contacto@biodiversidadvirtual.org

Normas de publicación:
http://www.biodiversidadvirtual.org/taxofoto/instrucciones-autores-que-deseen-publicar-en-bv-news-publicaciones-cientificas

FOTOGRAFÍA y BIODIVERSIDAD

Artículo nº 98

ISSN 1989-7170